BEFORE THE

Federal Communications Commission

WASHINGTON, DC 20554

In the Matter of	)	
	)	ET Docket No. 96-102
Amendment of the Commission's Rules to	)	RM-8648
Provide for Unlicensed NII/SUPERNet	)	RM-8653
Operations in the 5 GHz Frequency Range	)	

REPLY COMMENTS OF
AIRTOUCH COMMUNICATIONS, INC.

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AirTouch Communications, Inc. ("AirTouch")[1] hereby submits its reply comments regarding the Commission's *Notice of Proposed Rule Making* in the above-captioned proceeding.[2]

I. SUMMARY

The record before the Commission does not support the proposal to permit the operation of unlicensed NII/SUPERNet devices in the 5.15 - 5.25 GHz frequency range. The operation of the unlicensed NII/SUPERNet devices will interfere with mobile satellite service ("MSS") feeder links operating in the spectrum allocated at the 1995

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1 AirTouch is a wireless communications company with interests in cellular, paging, personal communications services, satellite and other operations. AirTouch is a limited partner in Globalstar, L.P., the entity formed to obtain investment in and coordinate international service for the Globalstar LEO mobile satellite system to be operated by Loral/Qualcomm Partnership, L.P. AirTouch intends to provide LEO mobile satellite services through Globalstar in countries throughout the world, including the United States.

2 *See Amendment of the Commission's Rules to Provide for Unlicensed NII/SUPERNet Operations in the 5 GHz Frequency Range*, ET Docket No. 96-102, RM-8648, RM-8653, *Notice of Proposed Rule Making*, 11 F.C.C.R. 7205 (1996) ("*NPRM*").

World Radiocommunications Conference ("WRC-95"). AirTouch estimates that such interference will reduce the capacity of its Globalstar satellite system in the United States by over 27.4% resulting in significant service degradation. Consequently, the Commission's proposal to permit operation of unlicensed NII/SUPERNet devices in that frequency band will interfere with licensed operations and is thus contrary to the requirements of Part 15 of the Commission's Rules and to the public interest. Therefore, the Commission should not allocate spectrum at 5.15 - 5.35 GHz for use by NII/SUPERNet devices on an unlicensed and "safe harbor" basis.

II. AS PROPOSED, AUTHORIZATION OF NII/SUPERNet DEVICES IS CONTRARY TO PART 15 OF THE COMMISSION'S RULES AND WILL NOT SERVE THE PUBLIC INTEREST.

The Commission rejected Apple Computer, Inc.'s ("Apple") proposal for a new Part 16 service in which the proposed unlicensed devices would "operate in protected spectrum reflected in a Part 2 allocation and share allocated frequencies,"[3] choosing instead to treat NII/SUPERNet devices under Part 15 of its Rules. However, the conditions proposed in the *NPRM* are flatly inconsistent with the important policies underlying Part 15 of the Commission's Rules and do not serve the public interest.

Traditionally, unlicensed Part 15 devices have no spectrum allocation status, but rather have a secondary status only:

> Persons operating intentional or unintentional radiators shall not be deemed to have any vested or recognizable right to continued use of any given frequency. . . .[4]

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[3] 11 F.C.C.R. at 7226-27.

[4] 47 C.F.R. § 15.5(a) (1995).

In addition, the devices are prohibited from causing harmful interference to and must accept interference from licensed radio services:

> Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station. . . .[5]

The underlying premise behind the non-interference conditions and the secondary status of unlicensed devices, indeed the whole of Part 15, is to balance the protection of licensed primary services, with the important contributions to the public interest of unlicensed devices.[6]

In the *NPRM*, however, the Commission proposes a service allocation for NII/SUPERNet devices and the adoption of a "safe harbor" rule for the devices which conflicts with the Part 15 regulatory scheme. Proposed Section 15.409(a) states that such devices "will not be deemed to cause interference to licensed services provided the devices operate in accordance with" the technical parameters adopted for the service.[7] Such a provision would effectively relieve unlicensed users from their obligation to avoid harmful interference to licensed services using the band, thereby upsetting the balance of interests underlying Part 15 of the Commission's Rules.

As discussed below, there is substantial, and unrefuted, evidence on the record of this proceeding showing that operation of the NII/SUPERNet devices in accordance with the technical standards proposed in the *NPRM* will cause unacceptable

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5 *Id.* at § 15.5(b).

6 *See Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices without an individual License*, GEN. Docket No. 87-389, *First Report and Order*, 4 F.C.C.R. 3493, 3494-95 (1989).

7 11 F.C.C.R. at 7233.

interference with MSS feeder links.[8] Thus, the safe harbor provision would effectively condone interference to MSS feeder links and elevate Part 15 uses to protected status. Such a result is wholly unwarranted and will undermine the hard-won allocation of frequencies to mobile satellite services and the important public benefits to be provided by MSS feeder links.

As discussed in AirTouch's initial comments to this proceeding, MSS feeder links are essential for the operation of the innovative, and consumer-oriented LEO mobile satellite services that AirTouch is preparing to launch by mid-1997.[9] Full deployment of its Globalstar satellite system will enable AirTouch to provide valuable telecommunications services to underserved markets throughout the world. The services offered through the Globalstar will serve the public interest. As the Commission has recognized:

> the Big LEO service can offer an almost limitless number of services, including ubiquitous voice and data mobile services, position location services, search and rescue communications, disaster management communications, environmental monitoring, paging services, facsimile transmission services, cargo tracking, and industrial monitoring and control. Domestically, this service will help meet the demand for a seamless nationwide and eventually global communications system that is available to all . . . .[10]

In addition, Globalstar will provide a cost-effective way to meet critical telecommunications needs in areas where telecommunications services are limited or unavailable

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8 *See infra* text at 6-9; *see also* Comments of L/Q Licensee, Inc. at 8-11 (filed on July 15, 1996).

9 Comments of AirTouch Communications 5-6 (filed July 15, 1996).

10 *Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, CC Docket No. 92-166, 9 F.C.C.R. 5936, 5940 (1994) (footnote omitted).

because installation of the necessary terrestrial infrastructure is uneconomic.[11] Moreover, businesses all over the United States will be able to link to the global information infrastructure, operate more efficiently and develop new markets for their products or services.[12]

Given the significance of MSS feeder links to its Globalstar satellite system, AirTouch has undertaken significant, costly and time-consuming efforts to ensure the availability of spectrum for its Globalstar satellite systems to operate in the United States and globally. In licensing the Globalstar system, the Commission conditionally assigned MSS feeder links in the 5.025-5.225 GHz and 6.875-7.075 GHz frequency bands pending global allocation of spectrum.[13] Accordingly, AirTouch and Globalstar L.P. actively participated in the WRC-95 and, together with the United States government and other conferees, was successful in obtaining spectrum allocations for MSS feeder links on a co-primary basis in the 5.091 - 5.250 GHz band.[14] Applications to assign spectrum at the 5.091 - 5.250 GHz and 6.875-7.055 frequency band for MSS feeder links for the Globalstar system are now pending before the Commission.[15]

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11 Comments of AirTouch Communications at 5-6.

12 "The Big LEO service also has the potential to stimulate significant economic growth in the United States and abroad. A potential multi-billion dollar industry will be created, generating opportunities for economic growth in a variety of markets." 9 F.C.C.R. at 5940-41.

13 *Loral/Qualcomm Partnership, L.P.*, 10 F.C.C.R. 2333, 2336 (1995).

14 *See* Comments of AirTouch Communications at 3, 5 n.9; *see also* Comments of L/Q Licensee, Inc. at 3.

15 File Nos. 88-SAT-WAIV-96, 90-SAT-ML-96, *Public Notice*, Report No. SPB-40 (rel. March 20, 1996).

Both AirTouch and the Commission have devoted substantial resources to ensuring spectrum allocations for MSS feeder links to support the Globalstar and other mobile satellite communications systems. The *NPRM*, however, threatens to undermine these important efforts by failing to protect the primary licensed MSS feeder link uses from harmful interference from unlicensed devices. Indeed, through the safe harbor provision, the *NPRM* would reverse the protections traditionally granted licensed users and expose MSS feeder links to substantial and harmful interference in favor of protecting unlicensed users. Such an unprecedented result clearly will not serve the public interest.

III. THE USE OF SPECTRUM AT 5.15 - 5.35 GHz BY NII/SUPERNet DEVICES WILL INTERFERE WITH MSS FEEDER LINK TRANSMISSION.

The Commission has indicated its belief that "NII/SUPERNet devices can successfully share spectrum with the MSS feeder links which are expected to operate in the 5.15 - 5.25 GHz band."[16] This sentiment was echoed in the comments of the Wireless Information Networks Forum ("WINForum").[17] The record in this proceeding, however, does not support this conclusion.

The joint comments of ICO Global Communications and Comsat Corporation, as well as the comments of L/Q Licensee, Inc., present technical analyses demonstrating the substantial potential for interference between NII/SUPERNet devices and

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16 11 F.C.C.R. at 7217-18.

17 *See* Comments of WINForum at 17-18 (filed July 15, 1996).

MSS feeder links.[18] In addition, and based upon its substantial expertise in wireless and satellite communications, AirTouch has also performed a technical analysis to estimate the likelihood for interference caused by the proposed NII/SUPERNet devices on the Globalstar satellite system.[19] This technical analysis demonstrates that, given the minimal technical standards under consideration, the proposed allocation of spectrum will create a substantial likelihood of a significant degradation to AirTouch's Globalstar system from the operation of the proposed devices. AirTouch estimates that the total interference introduced by the NII/SUPERNet devices will be -207.09 dBW/Hz.[20] This level of interference will reduce the capacity of the Globalstar system in the United States by over 27.4%[21] and thus constitutes harmful interference for purposes of Part 15 of the Commission's Rules.

Nothing in the record refutes AirTouch's analysis. The petitions for rule making underlying this proceeding, RM-8648 and RM-8653, as well as the comments in this proceeding, are notable for their lack of information supporting the feasibility of unlicensed operations in the proposed spectrum. WINForum and others present enthusi-

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18 *See* Appendix to Comments of Joint Commenters (filed July 15, 1996); *see also* Appendix to Comments of L/Q Licensee, Inc.

19 *See* Appendix A for a copy of this analysis. The analysis was prepared by Mark A. Schulz, an engineer and the Manager - RF Technology for AirTouch Communications, Inc. Given the paucity of hard data provided by WINForum, Apple and other parties supporting the *NPRM*, AirTouch's analysis is necessarily based upon a series of assumptions regarding the types and expected populations of NII/SUPERNet devices. The assumptions contained in the analysis are identified and supported.

20 Appendix A at 5.

21 *Id.*

astic claims of the benefits to be derived from NII/SUPERNet devices.[22] However, neither WINForum nor Apple have put forward studies addressing the potential for interference between NII/SUPERNet devices and MSS feeder links in the proposed spectrum bands.[23] Further, there is no adequate discussion of whether frequencies other than the 5 GHz bands proposed would be sufficient (if not preferable) for use by NII/SUPERNet devices.[24] Moreover, the proposals lack concrete information regarding critical system design elements.

The primary support posited for the conclusion that NII/SUPERNet devices and MSS feeder links can share spectrum is a single page of the International Telecommunications Union report concluding that there is a negligible risk of interference between HIPERLAN systems and MSS feeder links and the fact that standards for HIPERLAN are being developed.[25] HIPERLAN, however, is not analogous to the proposed NII/SUPERNet devices and thus the European analysis cannot be relied upon.

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22 *See, e.g.*, Comments of WINForum at 9-12.

23 One document presented by WINForum is the AT&T input paper to the Industry Advisory Committee concerning WRC-97. *See* Wireless Information Networks Forum Petition for Rulemaking, Appendix B (filed May 15, 1995). For the reasons set forth in the Comments of L/Q Licensee, this paper does not demonstrate the feasibility of sharing between NII/SUPERNet devices and MSS feeder links. Comments of L/Q Licensee, Inc. at 9-10.

24 Indeed, the Comments of L/Q Licensee, Inc. demonstrate that spectrum other than spectrum in the 5 GHz band would be adequate to provide the services proposed by Apple and WINForum for the NII/SUPERNet devices. Comments of L/Q Licensee, Inc. at 11-13. In addition, L/Q Licensee, Inc. demonstrates that while the existing Part 15 spectrum may be congested, there is substantial spectrum below 5 GHz which will become available for commercial use in the near future. *Id.* at 14.

25 *See* 11 F.C.C.R. at 7211, 7217-18, 7236.

HIPERLAN is presumed to be almost exclusively for indoor use.[26] NII/SUPERNet devices, on the other hand, are proposed to be portable and unlicensed. As such, and unlike HIPERLAN, once the proposed devices are in place, there is nothing to limit the number of devices or the location from which they will be used.

This distinction is significant because the proposed NII/SUPERNet devices will operate within the field of view of the Globalstar satellites and will transmit on frequencies those satellites are tuned to receive. Consequently, the potential for interference with MSS feeder links is directly related to the total number of NII/SUPERNet devices and the number of outdoor uses. There is substantial record evidence to show the percentage of outdoor uses for the NII/SUPERNet devices will be at least 50%,[27] substantially higher than the 1% of outdoor use envisioned for the HIPER-LAN system. Indeed, AirTouch submits that the percentage of outdoor uses for such devices will be 60% or greater.[28] Therefore, the Commission's reliance on European studies related to the HIPERLAN system to demonstrate the compatibility of NII/SUPERNet devices and MSS feeder links is not appropriate.[29] Simply put, the HIPERLAN studies provide no support for the proposition that the proposed unlicensed devices can share spectrum with MSS feeder links. Accordingly, AirTouch submits that

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26 11 F.C.C.R. at 7236 (stating "Roughly 99% or more of all HIPERLAN usage is projected to be indoors.").

27 *See* Comments of Joint Commenters at 3-4; *cf.* WINForum Comments at 7-8; Comments of Metricom, Inc. at 4-5; 11 F.C.C.R. at 7212-13.

28 Appendix A at 4.

29 In this regard, AirTouch notes that the Comments of L/Q Licensee, Inc. point out errors in the European analysis relied upon by the Commission. *See* Comments of L/Q Licensee, Inc., Appendix at 5-7. Such errors would further undermine the validity of the Commission's reliance upon the European analysis.

given the adverse impact on licensed MSS feeder links in this band, the Commission should not permit NII/SUPERNet devices to use the 5.15 - 5.25 GHz frequency band on a "safe harbor" basis.

IV. CONCLUSION

The Globalstar system and other mobile satellite communications systems will serve important public benefits and "may prove to be a critical component in the development of the global information highway."[30] To maximize the benefits to be derived from such systems, the Commission must protect the MSS feeder links which are a critical component to LEO services. Unlicensed NII/SUPERNet devices using spectrum in the 5.15 - 5.25 GHZ frequency band represent a substantial threat to the integrity and operation of MSS feeder links. Indeed, the interference from such devices developed according to the Commission's proposed technical standards will reduce the capacity of AirTouch's use of the Globalstar system in the United States by over 27.4%. Accordingly, the Commission should not authorize the proposed devices in the 5.15 - 5.25 GHz

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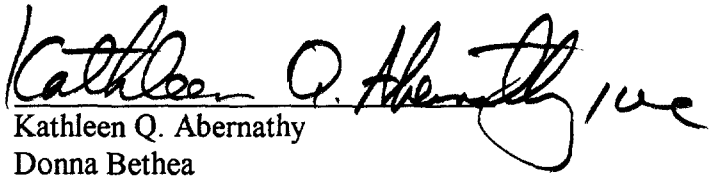
30 9 F.C.C.R. at 5940.

frequency band and in no event should such devices be given "safe harbor" protection against the licensed uses of the spectrum.

Respectfully submitted,

AIRTOUCH COMMUNICATIONS, INC.

By: 

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Appendix A

Technical Analysis Regarding Interference to MSS Links by Part 15 Devices Using 5.15-5.25 GHz Frequency Band

Introduction

This document presents an analysis showing the impact of operating Part 15 devices within the 5150 to 5250 MHz MHz frequency band of the Mobile Satellite Service (MSS) feeder links. The data presented here estimates interference caused by the proposed NII/SUPERNet devices on the Globalstar satellite system. Assumptions in this analysis are identified and supported by additional documentation.

Summary

The presence of additional interference in the MSS feeder uplink will degrade the capacity of the Globalstar system. Primarily, interference on the MSS feeder uplink will degrade the Eb/No experienced by the user terminal. To combat this interference, the power control of the CDMA system will increase the forward power of all the traffic channels. This increase in the Gateway and S/C power reduces the number of traffic channels the spacecraft can support at any one time. The analysis presented in this paper calculates the change in Eb/No in the user terminal and thus the change in system capacity caused by the additional interference of Part 15 devices in the frequency band. The analysis concludes that interference from Part 15 devices will reduce the capacity of the Globalstar system by over 27.4%, resulting in significant service degradation to the system.

Analysis Procedure

The Globalstar noise level that the satellite receives is dependent upon several different interference sources. Since this makes the Globalstar link budget very complex and dynamic, the following assumptions are made to simplify the calculations:

1. Since the spacecraft has an iso-flux antenna for the MSS uplink, the Gateway EIRP does not significantly change as a function of Gateway elevation. The Gateway power, however, is dependent upon the user elevation. If the user elevation is low, the EIRP of the Gateway is high to make up for the range loss of the spacecraft to the user terminal. Because of the circular coverage region of the satellite, most of the Globalstar devices will be at low elevations or in the outer beams. For this reason, the calculations presented here will focus on the forward link outer beam calculations performed in the Globalstar filing:

Globalstar Up Link Budget Filling

Globalstar Link Budget		
Gateway EIRP	27.40	dBWi
End to End Loss	-193.90	dB
Signal at LNA	-166.50	dBW
No at LNA	-203.90	dBW/Hz
Io at LNA	-209.60	dBW/Hz
Total Io+No at LNA	-202.86	dBW/Hz
Data Rate	2400.00	bps
Eb/(Io+No)	2.56	dB
Coherent Combining Gain	2.50	dB
Eb/No	5.06	dB

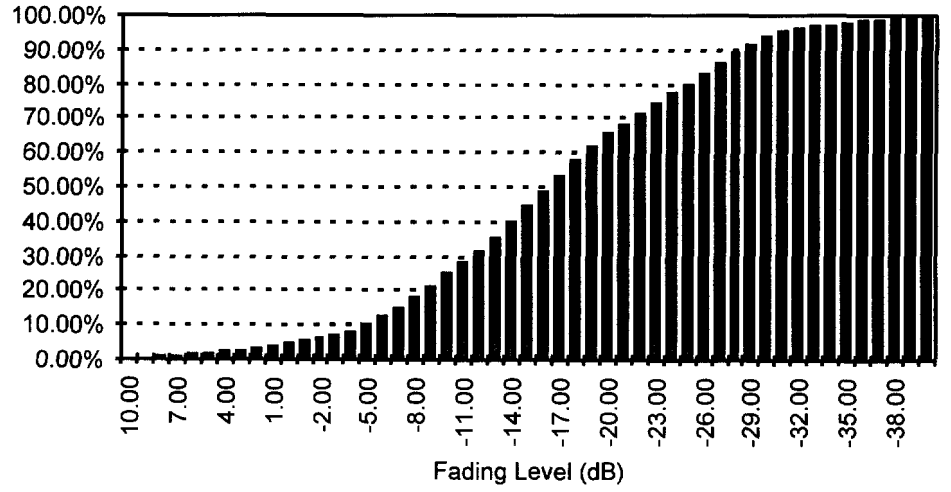
2. The interference level per Part 15 user is calculated from the following equations and assumptions:

   a) The maximum power transmitted by a Part 15 device is 0.03 milliwatts/3KHz or -80 dBW/Hz.

   b) User distribution of the Part 15 devices is not important since the Globalstar MSS uplink feeder will receive these devices at the same power for all locations. This is due to an iso-flux pattern receive antenna (i.e. path loss compensating).

   c) In-building loss data was derived from measurements performed by Wolfhard J. Vogel (et al) of the University of Texas under contract to JPL #956220. A summary of these results determined the mean path loss of GPS transmissions to various positions in various types of buildings to be approximately -17 dB. 5% of the cases had a path loss of less than -1 dB and 95% of the cases had a path loss of less than -31 dB. Figure 1 shows a cumulative distribution function for all of the in-building measurements.

Figure 1, In-Building Fading Measurements



d) If high gain antennas are used outdoors for Part 15 use and these high gain antennas are pointed towards the horizon, the average power the satellites receives from Part 15 devices will increase. This gain increase may be determined from the following equations. If we assume that these high gain antennas are pointed in random directions and uniformly distributed within the feeder link field of view, the average antenna gain may be expressed as:

$$G_{ave} = \frac{1}{2\pi\left(1-\sin\frac{\pi}{18}\right)} \int_{-\pi}^{\pi} \int_{\pi/18}^{\pi/2} G_a(\varepsilon,\alpha)\cdot\cos\varepsilon\cdot\partial\varepsilon\cdot\partial\alpha$$

Where the expression, $G_a(\varepsilon,\alpha) = \frac{27000}{Bw_\varepsilon \cdot Bw_\alpha} 10^{-12\left(\left(\frac{\varepsilon}{Bw_\varepsilon}\right)^2+\left(\frac{\alpha}{Bw_\alpha}\right)^2\right)} + 1$, may be used to represent the analytical Part 15 high gain antenna pattern. ε,α are the elevation and azimuth angles respectively and $Bw_\varepsilon, Bw_\alpha$ are the elevation and azimuth beamwidths. This gain equation assumes a uniform sidelobe gain of 0 dBi for all antenna beamwidths. Performing a numerical integration of this equation yields approximately 2 dB of average gain increase over an omni for beamwidths of 60°. As the beamwidth of the part 15 high gain antenna narrows, the gain goes up but we are averaging over less of the high portion of the beamwidth due to the integration starting at 10° elevation. Also, as the beamwidth broadens, the average gain goes down due the lower gain of the antenna. Antenna beamwidths around 60° seem to have the highest average gain increase over an omni.

e) The total interference from a Part 15 device transmitting may be expressed as $I_{P15} = EIRP_{p15}^{1user} + G_L + 10\log10(N_t \cdot \delta_c \cdot (f_o \cdot 10^{G_o/10} + (1-f_o)\cdot 10^{G_i/10}))$ where:

$EIRP_{p15}^{1user}$ = -80 dBW/Hz, the Part 15 power density,

G_L =-193.9 dB, the total end to end gain from Gateway to user LNA,

N_t = Number of terminals in CDMA frequency band.

δ_c = Transmit duty cycle

f_o = Ratio of outdoor devices to total devices,

G_o =2 dB, average gain of outdoor antennas over omni, and

G_i = -17 dB, average gain of transmission gain of indoor devices.

f) Capacity reduction may now be determined from $\Delta C = \frac{10^{I_{p15}/10}}{10^{I_{p15}/10} + 10^{I_I/10}}$ where:

I_{p15} = Part 15 interference as defined above and

I_I = -202.86 dBW/Hz, total interference as defined in Globalstar filling which includes:

- Globalstar other user interference
- Globalstar other beam interference
- Globalstar other S/C interference
- Globalstar S/C thermal noise and intermodulation products
- Globalstar handset thermal noise

g) The above equations are used to determine the capacity impact for the following list of assumptions:

1. Number of terminals = 50 million. This number is based upon FCC estimates.
2. Bandwidth/Terminal = 20 MHz. The Apple & NII/SUPERNet application documents indicate data rates of greater than 20 Mbps for LAN/WAN usage. Assuming rate 1/2 QPSK encoding, this yields 20 MHz of terminal bandwidth.
3. Terminals/CDMA Frequency Channel = 10 million. Based upon above numbers plus equal frequency usage (i.e. 50 million * 20Mhz /100Mhz).
4. Transmit Duty Cycle = 50%. AirTouch assumes that a device will either be transmitting or receiving at any one time, therefore the average transmission is 50%.
5. Outdoor Terminals = 60%. Since these devices could have a potentially high outdoor usage, due to services such as campus networks (i.e. Metricom), point to point communications and many other possible applications, AirTouch estimates that an outdoor usage of 60% may in fact be exceeded.

Conclusion

From the above assumptions, the total interference introduced by the Part 15 devices is calculated to be -207.09 dBW/Hz. This level of interference reduces the capacity of the Globalstar system in the United States by over 27.4%, resulting in significant service degradation.

DECLARATION

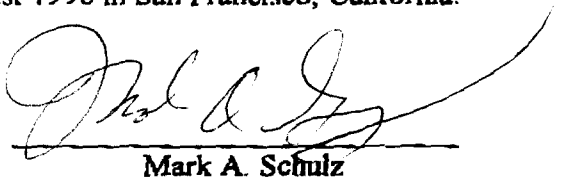
1. I, Mark A. Schulz, am an engineer and the Manager - RF Technology for AirTouch Communications, Inc. As such, I am familiar with the operational characteristics of wireless and mobile satellite communications technologies.

2. I am familiar with the operational characteristics for AirTouch's proposed Globalstar satellite system. I am also familiar with the rules and policies proposed for the NII/SUPERNet service in the Notice of Proposed Rule Making released May 6, 1996.

3. I prepared the foregoing "Technical Analysis" and the information presented therein is true and accurate to the best of my knowledge and belief.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

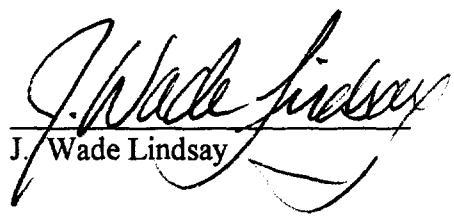
Signed this 13th day of August 1996 in San Francisco, California.



Mark A. Schulz

CERTIFICATE OF SERVICE

I, J. Wade Lindsay, hereby certify that I have, on this 14th day of August, 1996, served copies of the foregoing document via hand delivery upon each of the persons listed on the attached.



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